Computational Mathematics and Mathematical Physics 2010 vol.50 N9, pages 1553-1560

Hydrofoil flow over the interface of a two-layer heavy fluid with a free surface and rigid bottom

Kirillin K., Filippov S.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

The theory of small-amplitude waves is used to analyze the hydrofoil flow of a two-layer heavy fluid. The upper layer is bounded by a free surface, while the lower layer is bounded by a horizontal bottom. simulation of boundaries by singularities. Due to this method, the boundary condition specified on the contour is satisfied analytically exactly. By using the interface conditions, the problem is reduced to two systems of three singular integrodifferential equations. A special regularization technique gives systems of linear integral equations, which are solved numerically by applying the method of successive approximations with the use of a specially developed algorithm and a FORTRAN program. The numerical-analytical method developed applies to a wing section of arbitrary, including actual, shape placed in a fluid flow with interfaces of various types. The computations were performed for a NACA 66mod hydrofoil. The influence exerted by the angle of attack and the interfaces on the hydrodynamic hydrofoil characteristics is investigated in different ranges of Froude numbers. Shapes of internal and surface waves are obtained. Hydrodynamic effects associated with the dead water phenomenon are detected. © 2010 Pleiades Publishing, Ltd.

http://dx.doi.org/10.1134/S0965542510090083

Keywords

bounded channel, complex variable function method, gravity waves, hydrofoil, numerical simulation of boundaries by singularities, numerical solution of systems of linear Fredholm equations, open channel, two-layer fluid, wing contour, wing section